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**COURTESY COPY OF THE
PCT APPLICATION AS
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WITH ABSTRACT**

DESCRIPTION

FILTER FOR INTERNAL COMBUSTION ENGINES

TECHNICAL FIELD

5 The present invention relates, in a totally general sense, to internal combustion engines and more particularly to a filter for liquids, such as oil or diesel fuel, to be associated with said engines.

More specifically, the invention relates to improvements in the filter of Italian Patent Application No. RE2001A000065 in the name of the same

10 Applicant.

PRIOR ART

The filter described in said document comprises a generally cup-shaped casing which is closed by a removable cover, and contains a disposable

15 tubular filter cartridge.

Said cartridge divides the interior compartment of the cup into two chambers, of which one is connected to an inlet conduit for the liquid to be filtered, and the other is connected to an outlet conduit for the filtered liquid.

20 The cartridge is removably fixed in a sealed manner to the inner region of the cover by a snap connection system, which does not require detailed description. It is sufficient to note that the system comprises first engagement means which extend beyond the inner face of the cover or the facing end face of the cartridge, and second engagement means

25 matching the preceding and extending beyond said facing end face or said inner face, said first and second engagement means being

TEXT AS ORIGINALLY FILED

connected together by axially sliding the cover and cartridge towards each other, and being released by rotating the cover and cartridge relative to each other through a predetermined angle.

For other details of said snap connection system reference should be
5 made to the aforesaid document.

A problem which afflicts this known filter arises from the stated projecting arrangement of the constituent means of the snap connection system, which occupies a part of the cup length beyond the filter.

For this reason the filter possesses a filtration capacity less than that
10 which, for the same cup, it would possess if said connection system were absent, because in that case the cup would be able to contain a longer filter.

Moreover the initially stated known art involves the use of a relatively complex and hence relatively unreliable arrangement for associating with
15 the snap connection system a seal for adequately separating the passage chamber for the liquid to be filtered from the passage chamber for the filtered liquid.

DISCLOSURE OF THE INVENTION

20 The main object of the present invention is to remedy the aforesaid problem.

Another object of the invention is to achieve said object within the framework of a simple, rational, reliable and low-cost construction of small overall size.

25 Said objects are attained by a filter having the characteristics indicated in the claims.

TEXT AS ORIGINALLY FILED

In a totally general sense, the filter of the invention comprises a snap connection system between the cover and cartridge which is shaped and dimensioned such that, once engaged, it is practically completely contained within the central compartment passing through the cartridge,

5 where it maintains this latter locked in the immediate vicinity of the cover. By this means, the longitudinal extent of the snap connection system is practically contained within that of the cartridge, with the result that a longer cartridge than that allowable in the known art can be accommodated within the outer casing of the filter, with evident

10 advantages in terms of filtration characteristics.

Moreover with the aforedefined solution the arrangement for sealing the snap connection system is extremely simplified, as will be apparent hereinafter.

15 BRIEF DESCRIPTION OF THE DRAWINGS

The characteristics and the constructional merits of the invention will be more apparent from the ensuing description given with reference to the figures of the accompanying drawings which illustrate a particular preferred embodiment by way of non-limiting example.

20 Figure 1 is a partially sectioned side view of a filter according to the invention.

Figure 2 shows the detail II indicated in Figure 1 on an enlarged scale.

Figure 3 is a perspective view showing a detail of the filter.

Figure 4 is the section IV-IV of Figure 3.

25 Figure 5 is a view from below of another detail of the filter.

Figure 6 is the section VI-VI indicated in Figure 5.

BEST MODE FOR CARRYING OUT THE INVENTION

Said figures, and in particular Figure 1, show a filter for liquids, for example oil or diesel fuel, to be installed on an internal combustion 5 engine.

Said filter, indicated overall by 1 in Figures 1 and 2, comprises an outer casing 2 containing a disposable filter cartridge 3, and is closed by a cover 4.

The casing 2 is generally cup shaped, while the cartridge 3 is toroidal and 10 has an outer diameter less than the inner diameter of the casing or cup 2.

In this manner the interior cavity of the cup 2 is divided into an outer annular chamber 21 (see Figures 1 and 2) lying between the cup 2 and cartridge 3, and an inner cylindrical chamber 22 provided by the longitudinal central compartment passing through the cartridge 3.

15 An inlet conduit (not visible in the figures) for the liquid to be filtered opens into the outer chamber 21, the inner chamber 22 communicating with an outlet conduit 5 for the filtered liquid, provided on the cover 4.

The cover 4 is connected to the cup 2 by a ring nut 6 which is screwed onto a threaded collar 7 provided on the outside of the mouth of the cup 2, 20 an annular seal gasket being interposed between the cover 4 and collar 7.

The cartridge 3 comprises a circular base ring, not visible in the figures, and a circular head ring, indicated by 9 in Figures 1 and 2, with which an annular body, or bush, 10 is associated.

As shown in Figures 3 and 4, the bush 10 comprises an upper annular 25 part 100 and a lower annular part 101 which are of practically the same length but of different outer diameters, of which the lesser diameter

TEXT AS ORIGINALLY FILED

pertains to the lower part 101.

The lower part 101 is intended to be inserted practically as an exact fit into the upper portion of the central compartment of the cartridge 3 (see Figures 1 and 2), and locked thereat both axially and radially by the inner 5 annular edge of the ring 9 which rests against a circumferential ledge 102 provided at the base of the upper part 100 (Figures 1 and 2).

Above said ledge 102, said upper part 100 presents a circumferentially outer groove 103 acting as a seat for an annular gasket 12 (Figures 1 and 2).

10 As shown in Figures 3 and 4, the free end of the lower part 101 comprises a circumferential series of angularly equidistant rectangular recesses which in the illustrated embodiment are two in number.

To one side of each recess 104 there is provided a small internal projection 105, the opposite side thereto being of reduced thickness.

15 Said side of reduced thickness is provided by a depressed curved transverse surface 106 on the inner cylindrical surface of the bush 10, its centre of curvature being outside the longitudinal axis of said bush 10.

In this manner, starting from said side of reduced thickness, said depressed curved surface has a decreasing depth (Figure 3) which

20 becomes zero at a certain distance from the projection 105 associated with the next recess.

The described bush 10 acts as a means for coupling the cartridge 3 to the disc 11, which is conveniently locked in a suitable lower sunken seat in the cover (see Figures 1 and 2).

25 The disc 11 is shown in Figures 5 and 6 and comprises a central hole with which there are associated upwardly a tube 110 which communicates with

TEXT AS ORIGINALLY FILED

the outlet conduit 5 (Figure 1), and downwardly a coaxial sleeve 111 which is coaxial with the inner chamber 22 of the filter 1 (Figures 1 and 2). The sleeve 111 has an outer diameter practically equal to the inner diameter of the bush 10 (Figures 1 and 2), and from its lower edge there 5 branch two elastically flexible longitudinal tangs (Figure 6), each shaped as a sector of a cylindrical wall (Figure 5).

The free edge of the tangs 112 presents an outer tooth 113 along its entire width (Figures 1, 2, 5 and 6).

Finally, to the outside of the sleeve 111 there is an enclosing coaxial skirt 10 114 (Figures 5 and 6), the inner cylindrical surface of which provides the sealing surface for the gasket 12 (Figures 1 and 2).

The cartridge 3 is mounted and removed in the following manner, after separating the casing 2 from the cover 4.

The cartridge 3 is mounted (see Figures 1 and 2) by pushing it from the 15 bottom upwards, with the recesses 104 of the bush 10 aligned with the tangs 112 of the sleeve 111.

During this coupling step, the tangs 112 deform elastically inwards because of the interference between the teeth 113 and the inner surface of the bush 10, the tangs 112 resuming their original configuration on 20 termination of coupling, as the teeth 113 have then passed beyond the bottom edge of the recesses 104, with which they engage.

At the same time the upper part 100 of the bush 10 becomes inserted into the channel lying between the sleeve 111 and the skirt 114, to cause the annular gasket 12 to form a seal. It should be noted that during this step 25 the lower edge of the skirt 114 acts as an abutment to determine the end of insertion of the bush 10.

TEXT AS ORIGINALLY FILED

To remove the cartridge 3, it merely has to be rotated through the angle defined by the projections 105, and pulled downwards.

During said rotation, the teeth 113 slide along the curved surfaces 106, which act as release tracks for the teeth by making them gradually

5 disengage until their outer generators lie in contact with the inner cylindrical surface of the bush 10.